THOMAS E. BEALL, JR.
JOHN R. MATTINGLY*
DANIEL J. STANGER
SHRINATH MALUR*

GENE W. STOCKMAN
Of Counsel

JEFFREY M. KETCHUM
SCOTT W. BRICKNER
Registered Patent Agents

* Bar Membership Other Than Virginia

BEALL LAW OFFICES

ATTORNEYS AT LAW
104 EAST HUME AVENUE
ALEXANDRIA, VIRGINIA 22301

(703) 684-1120

PATENT, TRADEMARK
AND COPYRIGHT LAW

FACSIMILE: (703) 684-1157
E-MAIL: fsb@alex.dgsys.com

Date: December 6, 1999

Attorney Docket No. ASA-838

To: Assistant Commissioner for Patents
Washington, D.C. 20231

Sir: Transmitted herewith for filing is the patent application of:

Inventor: SEE ATTACHED LIST (K. TSUCHIYA et al)

For:
COMMUNICATIONS CONTROL METHOD AND INFORMATION RELAYING DEVICE FOR COMMUNICATIONS NETWORK SYSTEM

Enclosed are:

- [X] 6 Sheets of Drawings
- [ ] This application is being filed without an executed Declaration.
- [X] Priority is claimed from Japanese Application No. 10-347235 filed December 7, 1998. [ ] A certified copy is attached herewith.
- [ ] Copies of the disclosure documents listed on the attached PTO 1449 form and [ ] discussed in the specification or [ ] attached Information Disclosure Statement.
- [ ] A verified statement to establish small entity status under 37 CFR 1.9 and 1.27.
- [X] Specification: Abstract X, Description 32 pages; and 18 claim(s).
- [ ] Preliminary Amendment.
- [X] Executed Declaration.

The filing fee is calculated as shown below:

For:	No. Filed	No. Extra	Small Entity Rate	Small Entity Fee	OR	Large Entity Rate	Large Entity Fee
Basic Fee				$ 380			$ 760
Total Claims	18 -20=	* 0	x 9	$		x 18	$ 0
Indep Claims	3 - 3 =	* 0	x 39	$		x 78	$ 0
[ ] Multiple Dependent Claim (s)			+ 130	$		+ 260	$ 0
			Total	$		Total	$ 760

* If difference is less than zero then enter '0' in second column

- [X] A check in the amount of $ 760.00 is enclosed for the filing fee.
- [X] The Commissioner is hereby authorized to charge any additional fees that may be required to Deposit Account No. 02-1540. A duplicate of this sheet is attached.

Respectfully Submitted,

By: _____
Thomas E. Beall, Jr.
Registration No. 22,410

ASA-838
E4941-01EU

LIST OF INVENTORS' NAMES AND ADDRESSES

Kazuaki TSUCHIYA, Ebina-shi, JAPAN;

Shinji NOZAKI, Yokohama-shi, JAPAN.

ASA-838
E4941-01EU

United States Patent Application

Title of the Invention

COMMUNICATIONS CONTROL METHOD AND INFORMATION RELAYING DEVICE FOR COMMUNICATIONS NETWORK SYSTEM

Inventors

Kazuaki TSUCHIYA,

Shinji NOZAKI.

COMMUNICATIONS CONTROL METHOD AND INFORMATION RELAYING DEVICE FOR COMMUNICATIONS NETWORK SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a communications control technology and an information relaying technology intended for a communications network system such as a LAN (Local Area Network). More particularly, the present invention relates to the technology which may be effectively applied to a communication control method intended for an inter-network device such as a LAN switch (Layer 2 switch, Layer 3 switch, or the like) and a communications network system composed of the inter-network devices.

One of the technologies characterized by the LAN switch is a VLAN (Virtual LAN). The VLAN is a technology which makes it possible to build the LAN without depending upon a physical port of the inter-network device. The VLAN may be divided into the following types; a port-based VLAN, a MAC (Media Access Control) address-based VLAN, a Layer 3 protocol-based VLAN, an IP (Internet Protocol) subnet-based VLAN, and the like.

For example, in the communications network system of the IP subnet based VLAN, a LAN switch 210 provided with plural ports 221 to 225 receives packets destined for a PC (Personal Computer) 233 from a PC 231. In response, the LAN switch 210 operates to learn a source MAC address and a source IP address and then create a host table 220. Then,

the LAN switch 210 operates to refer to the host table with the destination IP address of the received packet as a key and then, if the host table 220 includes an entry having the corresponding destination IP address to the source IP address, output the packet to the port specified by a port number field of the entry. If such an entry is not found in the host table 220, the LAN switch 210 operates to refer to a routing table (not shown) and an ARP (Address Resolution Protocol) table (not shown) for determining a next hop. Then, the LAN switch 210 operates to create a new entry of the host table 220 and then output the packet to the corresponding port to the next hop. The foregoing procedure is the relaying operation of the LAN switch 210 from the PC 231 to the PC 233.

Further, the LAN switch 210 operates to periodically delete an entry of the host table 220 and newly learn the addresses based on the source and the destination information of the received packet for keeping the entry of the host table 220 being updated. Hence, if the PC is moving to another place, the LAN switch 210 may correctly relay the packets to the moved port. That is, if the PC is moved, the PC may automatically restart the communication in a similar manner to that before movement.

SUMMARY OF THE INVENTION

However, the foregoing prior art has the following technical problems.

First, the prior art has no guard against the

erroneous setting of an IP address or the like. For example, it is assumed that a user of the PC 232 erroneously sets an IP address of the PC 231 to the PC 232 and connects the PC 232 to the port 222. In this assumption, the LAN switch 210 determines that the PC 231 is moved from the port 221 to the port 222 and rewrites the host table 220 based on the determination. As a result, some communication failure may take place. For example, the PC 231 with the correct IP address set thereto disables to do any communication. If lots of PCs are connected to the network, it is necessary to do a wasteful and troublesome work to analyze the cause of the communication failure and recover the communication from the failure.

Second, the prior art allows a malignant user to tap the data or pass himself or herself off as another person. For example, it is assumed that a user of the PC 235 erroneously sets the IP address of the PC 231 to the PC 235 and connects the PC 235 to the port 255. In this assumption, the LAN switch 210 determines that the PC 231 is moved from the port 221 to the port 225 and rewrites the host table 220 based on the determination. As a result, the user of the PC 235 receives the data destined for the PC 231 and taps it or passes himself or herself off as the user of the PC 231.

It is an object of the present invention to provide a management technology and an information relaying technology of a communications network system which make it possible to prevent the communication failure caused by

erroneously setting a logical or physical network address and to speed up the analysis of the cause of the communication failure and the recovery from the communication failure.

It is another object of the present invention to provide a management technology and an information relaying technology of a communications network system which make it possible to improve security of the communications network system by preventing tapping data or feigning another person by a malignant user.

According to the invention, a management method of a communications network that is configured by connecting user terminals or other relaying devices to plural I/O ports provided in the information relaying device such as the LAN switch and enables to dynamically change the connecting state of the I/O ports with each user by learning the change of the connecting state of each user terminal with an I/O port and updating a control table for managing correspondence between the I/O ports and the network address, comprises the steps of executing a user authentication to a user terminal having transmitted the communication information when a request causes updating a control table about the connecting state in response to sending and receiving information between the user terminals, that is, between I/O ports and updating the control table and sending and receiving information based on the updated table only if the user is authenticated as a true person.

Further, the management method comprises the steps of registering contact mail addresses of each user terminal and a system administrator in an authentication table having stored network addresses, user names, passwords and the like used for the user authentication and sending a message having described occurrence of the update request to a user terminal having transmitted information, a system administrator and the like by e-mail. In this sending operation, whether or not the user authentication is successful, the user name obtained by the user authentication is stored in the message.

Concretely, the present invention has the following features.

As a first respect, the present invention provides a management method of the LAN switch network system which enables to prevent communication failure caused by erroneously setting an IP address or the like and tapping data or feigning another person by a malignant user in a communications network system composed of LAN switches and is characterized by the following points in the communications network system such as an IP subnet-based VLAN or the like:

(a) About each PC connected to the LAN switch, the administrator of the LAN switch pre-registers the IP address and its relevant user name, password and contact mail address in the LAN switch according to each user's setting. The administrator of the LAN executes the registration from the administrator's terminal connected to

the LAN switch.

(b) Likewise, the administrator of the LAN switch pre-registers his or her own contact mail address to the LAN switch.

(c) The LAN switch creates an authentication table for registering information on each PC and the administrator of the LAN switch.

(d) In receipt of a packet destined for a PC from another PC, the LAN switch creates a host table by learning a source MAC address and a source IP address of a packet. If the entry corresponding to the source IP address is not included in the host table and thus is newly created or the terminal connecting information of the entry is rewritten into different content, at the port for receiving the packet, the LAN switch prompts the user name and the password for the PC having the source IP address of the packet. The LAN switch then waits for the user name and the password being given back thereto and then sends a message that a request of rewriting the host table occurs (the message including the user name given back from the PC as the information) to the contact mail address corresponding to the source IP address included in the authentication table. Unless the user name and the password pre-registered in the authentication table can be obtained (including no response being given back within a given interval of time), the LAN switch operates to stop rewriting of the entry in the host table and discard the relevant packet. If the user name and the password pre-registered in the authentication table

can be obtained, the LAN switch operates to refer to the host table with the destination IP address of the packet as a key. If the entry having the corresponding source IP address to the destination IP address is included in the host table, the LAN switch operates to output the packet to the port specified by a port number field of the entry. If no entry can be found, the LAN switch operates to refer to the routing table and the ARP table for determining the next hop, newly create the entry of the corresponding host table, and output the packet to the port connecting to the next hop.

The management method of the LAN switch network system viewed from the first respect makes it possible to automatically restart the similar communication to that before the movement if each PC is moved from one port to another port of the LAN switch. In this movement, the pre-registered user name and password are prompted by the LAN switch. Hence, no user other than the user having known the password can tap the information or pass itself off as another user. Moreover, a user of a PC may erroneously set the IP address of another PC to his or her PC and connects to the port of the LAN switch. In this case, the message reporting the erroneous setting (including the user name of the PC having the erroneously set IP address) is sent to the user of another PC and the administrator of the LAN switch. Hence, the user of another PC and the administrator of the LAN switch can easily classify (analyze) the cause of the failure. This makes it possible to do a swift

recovering process.

From a second aspect, the present invention provides the LAN switch which has the following means.

(a) Communicating means for transferring packets between the ports of the LAN switch.

(b) Relaying means for relaying a packet passed from the communicating means and indicating the communicating means to output the packet from one of the ports. The relaying means performs the following operations when relaying information.

The relaying means creates a host table by learning the source MAC address and the source IP address of the packet passed from the communicating means. If no entry corresponding to the source IP address is included in the host table and thus a new entry is created or the terminal connecting information of the corresponding entry is rewritten into different content, the relaying means operates to inquire the permission of rewriting (including new creation) of the below-described authenticating means. If a notice about inhibit of rewriting is received as a result of the inquiry, the relaying means operates not to rewrite the entry of the host table 1 and discard the corresponding packet. If a notice about permission of rewriting is received, the relaying means operates to refer to the host table with the destination IP address of the packet as a key. If the entry having the corresponding source IP address to the destination IP address is included in the host table, the relaying means operates to instruct

the communicating means to output the packet to the port. If no such an entry is included in the host table, the relaying means operates to refer to the routing table and the ARP table for determining the next hop, newly create the entry corresponding to the host table, and instruct the communicating means to output the packet to the suitable port.

(c) Authenticating means for authenticating a user based on a user name and a password pre-registered in the authentication table. The authenticating means performs the following operations in authenticating the user.

The authenticating means operates to register an IP address, a user name, a password, a contact mail address, and the like of each PC pre-entered through a management terminal or the like for creating an authentication table. In response to an indication given from the relaying means, the authenticating means operates to create a message for giving a request for an input of a user name and a password to the PC of the indicated IP address and instruct the communicating means to send out the packet to the proper port. At a time, the authenticating means waits for the user name and the password being given back thereto, creates a message for reporting the message that a request of rewriting an entry of the host table takes place (the message including the user name being given back from the PC) to the corresponding contact mail address to the IP address included in the authentication table, and instructs

the communicating means to send out the created message. If the user name and the password being given back thereto are not registered in the authentication table (including the case that no response is given back within a given interval of time), the authenticating means operates to notify the relaying means 13 of the inhibit of rewriting the entry of the host table. If the user name and the password being given back thereto are pre-registered in the authentication table, the authenticating means operates to notify the relaying means of the permission of rewriting the entry of the host table.

The LAN switch according to the second respect is arranged to preferably implement the management method of the LAN switch network system arranged from the first respect.

From the third respect, in the LAN switch arranged as described above, the authenticating means operates to create a message of requesting the PC of the IP address of the entry of the host table indicated by the relaying means to send the user name and the password, instruct the communicating means to send out the packet to the proper port. If the user name and the password being sent are not registered in the authentication table (including the case that no response is being given back within a given interval of time), the authenticating means operates to notify the relaying means 13 of the inhibit of rewriting the entry of the host table as well as instruct the relaying means to disable the port having received the

packet and discard all the packets received from the port.

The LAN switch arranged according to the third respect enables to reduce the traffic load of repeating a request for entering a user name and a password burdened when the IP address or the like is erroneously set or a malignant user taps the data or passes himself or herself off as another person by using the address of another PC.

From a fourth respect, in the LAN switch arranged as described above, the authenticating means creates a message of requesting the PC of the IP address of the entry of the host table indicated by the relaying means to send the user name and the password, and instructs the communicating means to output the message to the receive port. If the user name and the password being sent thereto are not registered in the authentication table (including the case that no response is given back thereto within a given time of interval), the authenticating means notifies the relaying means of the inhibit of rewriting the entry of the host table, creates a message of warning the user of each PC belonging to the same VLAN as the source IP address of the packet of a possibility of malignant communications done by the malignant user such as tapping data and passing himself or herself off as another person, and instructs the communicating means to send out the warning message.

From another aspect of the fourth aspect, in the LAN switch arranged as described above, the authenticating means operates to create a message of requesting the PC of the IP address of the entry of the host table indicated by

the relaying means to send the user name and the password and instruct the communicating means to output the packet to the receive port. Only if the user name and the password being sent are not registered in the authentication table (including the case that no response is being given back within a given interval of time), the authenticating means operates to create a message of reporting that a rewrite of the host table is failed to the contact mail address corresponding to the source IP address included in the authentication table and then instruct the communicating means to send out the message.

The foregoing LAN switch makes it possible to issue to a concerned user or a user to be possibly concerned a warning message that the IP address or the like is erroneously set or a malignant user intends to tap the data or pass himself or herself off as another person by using an address of another PC.

Further, the foregoing LAN switch is arranged to eliminate mails to be sent to a true user at a successful rewriting time (if a true user does communications in a proper range of use) for reducing a traffic amount and to report the result only if the rewrite is failed for more rapidly classifying (analyzing) the cause of the failure and recovering the communication from the failure.

From a fifth respect, in the LAN switch arranged as described above, the authenticating means is served to inquire each entry of the user name and the password periodically, not at the time of newly creating or

rewriting the entry of the host table.

The LAN switch arranged from the fifth respect is arranged to check if the IP address is erroneously set or if the malignant user taps the data or pretends to be another user by using the address of another PC with respect to the PC dedicated to receiving the packets.

The LAN switch arranged from the fifth respect operates to check if the port is erroneously connected, the IP address is erroneously set, or a malignant user sets the IP address of a true user to the port to which the true user has being connecting for tapping data or passing himself or herself off as a true user.

From a sixth respect, in the LAN switch arranged as described above, the relaying means operates to inquire the authenticating means of whether or not an entry is to be rewritten at a time of newly creating an entry of the corresponding host table to the source IP address of the received packet or rewriting the entry of the host table. At a time, about the destination IP address of the received packet, likewise, the relaying means operates to inquire the authenticating means of whether or not an entry is to be rewritten at a time of newly creating or rewriting an entry having the corresponding destination IP address of the host table to the source IP address.

The LAN switch arranged according to the sixth respect is arranged to check if the IP address or the like is erroneously set or a malignant user taps data or passes himself or herself off as another user by using an address

of another PC with respect to the PCs dedicated to receiving the packets.

The LAN switch arranged according to the sixth respect is arranged to check if the port is erroneously connected, the IP address is erroneously set, or a malignant user sets an IP address of a true user to the PC and connects the PC to the port to which the true user has being connecting for tapping the data or passing himself or herself off as a true user in communication by using the address of another PC.

Further, the LAN switch arranged according to the sixth respect is arranged to check if the port is erroneously connected, the IP address is erroneously set, or a malignant user sets an IP address of a true user and connects the PC to a port to which the true user has being connecting for tapping the data or passing himself or herself off as a true user in communication by using the IP address of the true user.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a conceptual view showing an arrangement of a LAN switch for implementing a management method of a communications network system according to a first embodiment of the present invention;

Fig. 2 is a conceptual view showing an example of a host table used in the LAN switch according to the first embodiment of the invention;

Fig. 3 is a conceptual view showing an example of

an authentication table used in the LAN switch according to the first embodiment of the invention;

Figs. 4 to 6 are flowcharts showing an operation of the LAN switch according to the first embodiment; and

Fig. 7 is a conceptual view showing an IP subnet based VLAN according to the prior art of the present invention.

DESCRIPTION OF THE EMBODIMENTS

Hereafter, the embodiments of the invention will be described with reference to the appended drawings.

Fig. 1 is a conceptual view showing an arrangement of a LAN switch for implementing a management method of a communications network system according to a first embodiment of the invention and an IP subnet based VLAN to which the LAN switch is applied. Figs. 2 and 3 are conceptual views showing various kinds of control informations used in the LAN switch according to this embodiment. Figs. 4 to 6 are flowcharts showing the management method of the communications network system and the function of the LAN switch according to this embodiment.

The LAN switch 11 of this embodiment is arranged to relay packets among ports 21 to 25 based on a host table 14 as shown in Fig. 2 created by learning the connection information from the received packets (communication information), for realizing the communication among the PCs 31 to 34. The LAN switch 11 is composed of a communicating unit (communicating means) 12, a relaying unit (relaying

means) 13, and an authenticating unit (authenticating means) 15.

The communicating unit 12 is served to transfer packets among the ports 21 to 25. This unit 12 is composed of electronic devices such as a CPU, an ASIC, a RAM, and a ROM.

As illustrated in Fig. 2, the host table 14 stores a source IP address 14a, a source MAC address 14b, an destination MAC address 14c, a port number 14d, and a belonging network 14e in a manner to make those kinds of data correspond with one another. The belonging network 14e indicates a network like a VLAN to which the port indicated by the port number 14d belongs. The host table 14 is provided in a storage device such as a RAM together with an authentication table 16 (to be discussed below). If the destination terminal is not directly connected to the LAN switch, the MAC address of the next hop is set to the destination MAC address 14c. The destination MAC address 14c is optional and may be used for more detailed analysis when the address of the connecting terminal is erroneously set or the address is incorrectly or illegally used. Further, for the similar purpose, the destination IP address may be set to the host table 14.

The authenticating unit 15 is served to determine if the rewrite of the host table 14 is enabled. This unit is composed of electronic devices such as a CPU, an ASIC, a RAM, and a ROM. The information based on which the rewrite is determined to be enabled or disabled is pre-registered

in the authentication table 16 (to be discussed below).

Fig. 3 is a view showing the authentication table 16 used in the LAN switch 11 according to this embodiment. The authentication table 16 holds the IP addresses 16a of the PC 31 to 34, the user names 16b of those PCs, the passwords 16c, and the contact mail addresses 16d, registered through a console terminal (not shown) or the like.

At first, the description will be oriented to the operation of the communication from the PC 31 to the PC 33.

Fig. 4 is a flowchart showing an example of an operation of the LAN switch 11 and the management method of the communications network system of this embodiment in the case of communicating the data from the PC 31 to the PC 33.

The administrator of the LAN switch 11 pre-registers the IP addresses of the PCs 31 to 34, the user names of the PCs 31 to 34, the relevant passwords, and the contact mail addresses through the management terminal or the like. Likewise, the administrator of the LAN switch 11 pre-registers his own contact mail address. In correspondence with these registrations, the LAN switch 11 creates the authentication table 16 in which the information about the PCs 31 to 34 and the administrator of the LAN switch 11 are registered.

The PC 31 operates to create the packets destined for the PC 33 and then send out them to the port 21 (step 101). The communicating unit 12 of the LAN switch 11 operates to receive the packets from the port 21 and then

pass them to the relaying unit 13 (step 102). The relaying unit 13 operates to learn the source MAC address, the destination MAC address which is optional, and the source IP address of the received packet and to create the host table 14 based on the learned data. At this time, if no corresponding entry to the source IP address is found in the host table 14 so that a new entry may be created or if the connecting information (corresponding information of a port, a source IP address and a source MAC address) of the terminal is rewritten in correspondence with the entry, an inquiry as to if the entry may be rewritten (or a new entry may be created) is issued to the authenticating unit 15 (step 103). If no rewrite (new creation) is required, the operation goes to a step 110. The present case holds true to the first packet of the communication data, so the operation goes to the next step for creating a new entry. As to the case of the second packet or later, the operation goes to the step 110.

The authenticating unit 15 operates to create a prompt message for a user name and a password (referred to as a message A), instruct the communicating unit 12 to send out the message, and wait for a given interval of time (step 104). The communicating unit 12 operates to send out the message A to the IP address of the proper port (in this case, the port 21) to the packet (step 105). The communicating unit 12 operates to receive the response message of the message A, that is, the input message of the user name and the password (referred to as a message B) from the PC

31, process the response message, and then pass the processed message to the authenticating unit 15 (step 106).

The authenticating unit 15 operates to compare the IP address, the user name, and the password stored in the message B with the IP address 16a, the user name 16b, and the password 16c written in the authentication table 16, make sure of the coincidence, create a message for reporting a request of rewriting the host table 14 to the contact mail address 16d registered in the entry of the authentication table 16 (which message is referred to as a message C, the message C containing the user name stored in the message B), and instruct the communicating unit 12 to send out the message C (step 107) as well as notify the relaying unit 13 of the rewrite enable (step 109). The communicating unit 12 operates to send out the message C to the mail address (step 108).

When the relaying unit 13 receives a notice about a rewrite enable from the authenticating unit 15, the relaying unit 13 operates to rewrite the concerned entry of the host table 14, refer to the host table 14 with the destination IP address as a key, if an entry having the source IP address which coincides with the destination IP address is found, instruct the communicating unit 12 to output the packet to the concerned port, if no such an entry is found, refer to a routing table (not shown) and an ARP table (not shown) for determining the next hop, newly create the corresponding entry in the host table 14, and instruct the communicating unit 12 to output the packet to

the port (step 110). The communicating unit 12 is served to send out the packet to the port (step 111).

The foregoing process is executed for starting the communication from the PC 31 to the PC 33.

Next, the description will be oriented to the operation of doing communications from the PC 31 to the PC 33 after the PC 31 is moved from the port 21 to the port 25. The operation is analogous to that shown in Fig. 4 except that the corresponding entry to the IP address of the PC 31 has been already created in the host table 14.

The PC 31 operates to create the packet destined for the PC 33 and then send it out to the port 25 (step 101). The communicating unit 12 of the LAN switch 11 is served to receive and process the packet and then pass it to the relaying unit 13 (step 102).

The relaying unit 13 is served to learn the source MAC address, the destination MAC address, and the source IP address of the received packet and then create the host table 14 based on the learned data. At this time, if no corresponding entry to the source IP address is found in the host table 14 and such an entry is newly created or if the terminal connecting information of the concerned entry is rewritten, an inquiry as to if the entry rewrite (and the new entry creation) is enabled is given to the authenticating unit 15 (step 103). If no rewrite (and new entry creation) is required, the operation goes to the step 110. This case holds true to the first packet of the restarted communication after movement. The operation goes

to a next step at which the entry information is to be rewritten. As to the second packet or later, the operation goes to the step 110.

The authenticating unit 15 operates to create a prompt message (referred to as a message A) for a user name and a password, instruct the communicating unit 12 to send it out, and wait for a given interval of time (step 104). The communicating unit 12 is served to send out the message A to the IP address of the receive port to the packet (step 105). When the communicating unit 12 receives the response message of the message A, that is, an input message of the user name and the password (referred to as a message B), the communicating unit 12 operates to receive and process the response message and then pass it to the authenticating unit 15 (step 106). The authenticating unit 15 operates to compare the IP address, the user name, and the password stored in the message B with the IP address 16a, the user name 16b, and the password 16c written in the authentication table 16, make sure of the coincidence, create a message for reporting a content that a request takes place of rewriting the host table 14 to the contact mail address 16d registered in the concerned entry of the authentication table 16 (which message is referred to as a message C, the message C containing the user name stored in the message B), and instruct the communicating unit 12 to send out the message (step 109). The communicating unit 12 is served to send out the message C to the mail address (step 108).

On the other hand, when the relaying unit 12

receives the notice about the rewrite enable from the authenticating unit 15, the relaying unit 13 operates to rewrite the concerned entry of the host table 14, refer to the host table 14 with the destination IP address as a key, if an entry having the source IP address coincident with the destination IP address is found, instruct the communicating unit 12 to output the packet to the concerned port, if no concerned entry is found, refer to a routing table (not shown) and an ARP table (not shown) for determining the next hop, newly create an entry of the concerned host table 14, and instruct the communicating unit 12 to output the packet to the concerned port (step 110). The communicating unit 12 is served to send out the packet to the concerned port (in this case, the port 25) (step 111).

The foregoing process makes it possible for the PC 31 to automatically restart the communication with the PC 33 after the PC 31 is moved from the port 21 to the port 25.

In turn, the description will be oriented to the operation of starting the erroneous communication between the PC 32 and the PC 33 when the PC 32 erroneously sets the IP address of the PC 31 and then connects to the port 22.

Fig. 5 is a flowchart showing an operation of the LAN switch and the management method of the communications network system of this embodiment when the PC 32 erroneously sets the IP address of the PC 31 and connects to the port 22 and then starts the communication with the PC 33.

The PC 32 operates to create the packets destined

for the PC 33 and then send them out to the port 22 (step 121). The communicating unit 12 of the LAN switch 11 operates to receive and process the packets and then pass them to the relaying unit 13 (step 102). The relaying unit 13 operates to learn the source MAC address, the destination MAC address, and the source IP address of the received packet and create the host table based on the learned data. At this time, if no corresponding entry to the source IP address is found in the host table 14 and thus the corresponding entry is newly created or if the terminal connecting information of the corresponding entry is rewritten, an inquiry as to if the entry rewrite (and new creation) is enabled is given to the authenticating unit 15 (step 103). If no rewrite (and new creation) is required, the operation goes to the step 110. This case holds true to the first packet of the communication data provided when the PC 32 erroneously sets the IP address of the PC 31 and connects to the port 22 and starts the communication with the PC 33. The operation goes to a next step at which the entry information is to be rewritten. In this case, the rewrite of the entry information is failed. Hence, as to the second packet or later, the operation goes to the next step.

The authenticating unit 15 operates to create a prompt message for a user name and a password (referred to as a message A), instruct the communicating unit 12 to send it out, and wait for a given length of time (step 104). The communicating unit 12 is served to send out the message

A to the IP address of receive port (in this case, the port 22) of the concerned packet (step 105). When the communicating unit 12 receives the response message to the message A, that is, the input message of the user name and the password (referred to as a message B), the communicating unit 12 processes the received data and then passes it to the authenticating unit 15 (step 106). The authenticating unit 15 operates to compare the IP address, the user name, and the password stored in the message B with the IP address 16a, the user name 16b, and the password 16c written in the authentication table 16, makes sure of no coincidence, create a message for reporting that a request takes place of rewriting the host table 14 to the contact mail address 16d registered in the concerned entry of the authentication table 16 (which message is referred to as a message C, the message C containing the user name stored in the message B), and instruct the communicating unit 12 to send out the message (step 108) as well as notify the relaying unit 12 of the rewrite inhibit (step 122). The communicating unit 12 is served to send out the message C to the mail address. (In this case, the message C is sent to the PC 31 having a true owner of the IP address erroneously set by the PC 32.) (step 108). On the other hand, when the relaying unit 13 receives the notice about the rewrite inhibit from the authenticating unit 15, the relaying unit 13 operates to cancel the rewrite of the concerned entry of the host table 14 and then discard the packet (step 123).

In the foregoing process, when the PC 32 erroneously sets the IP address of the PC 31 and thus connects to the port 22, the message for reporting the erroneous connection (including the user name of the PC 32 having erroneously set the IP address) is sent to the true user of the PC 31 and the administrator of the LAN switch 11. Hence, the user of the PC 31 and the administrator of the LAN switch 11 can easily analyze the cause of the failure, so that the rapid recovery is made possible.

In turn, the description will be oriented to the operation executed when the PC 35 owned by a malignant user sets an IP address of the PC 31 and connects to the port 25 and starts the communication with the PC 33.

Fig. 6 is a flowchart showing an operation of the LAN switch 11 and the management method of the communications network system according to this embodiment provided when the PC 35 owned by the malignant user sets the IP address of the PC 31 and connects to the port 25 and starts the communication with the PC 33.

The PC 35 is served to create the packets destined for the PC 33 and send them out to the port 25 (step 131). The communicating unit 12 of the LAN switch 11 is served to receive and process the packets and then pass the processed packets to the relaying unit 13 (step 102).

The relaying unit 13 is served to learn the source MAC address, the destination MAC address, and the source IP address of the received packet and create the host table 14 based on the learned data. If no correspond-

ing entry to the source IP address is found in the host table 14 and thus such a corresponding entry is newly created or the terminal connecting information of the concerned entry is rewritten, an inquiry as to if the entry rewrite (including the new creation) is enabled is given to the authenticating unit 15 (step 103). If no rewrite (including new creation) is required, the operation goes to a step 110. This case holds true to the first packet of the communication data provided when the PC 35 of the malignant user sets the IP address of the PC 31 and connects to the port 25 and starts the communication with the PC 33. The operation goes to a next step of rewriting the information of the entry. In this case, as a result, if the rewrite of the entry information is failed, as to the second packet or later, the operation goes to the next step as well.

The authenticating unit 15 is served to create a prompt message for a user name and a password (referred to as a message A), instructs the communicating unit 12 to send out the message A, and wait for a given length of time (step 104). The communicating unit 12 is served to send out the message A to the IP address of the proper port to that packet (in this case, the port 25) (step 105). When the communicating unit 12 receives the response message to the message A, that is, the input message of the user name and the password (referred to as a message B), the communicating unit 12 is served to receive and process the message B and then pass it to the authenticating unit 15 (step

106).

The authenticating unit 15 operates to compare the IP address, the user name, and the password stored in the message B with the IP address 16a, the user name 16b, and the password 16c written in the authentication table 16, make sure of no coincidence, create a message for reporting a content that a request takes place of rewriting the host table 14 to the contact mail address 16d registered in the concerned entry of the authentication table 16 (which message is referred to as a message C, the message C including the user name stored in the message B or, if the message B has no user name or does not reach within a given interval of time, the information for reporting it), and send out the message B to the communicating unit 12 (step 122) as well as notify the relaying unit 13 of the rewrite inhibit (step 109).

The communicating unit 12 is served to send out the message C to the mail address (in which case the message C reaches not the packet sender PC 35 but the true user PC 31) (step 108).

When the relaying unit 13 receives the notice about the rewrite inhibit from the authenticating unit 15, the relaying unit 13 operates to cancel the rewrite of the corresponding entry of the host table 14 and discard the packet (step 123).

In the foregoing process, if the PC 35 of the malignant user sets the IP address of the PC 31 and connects to the port 25, the PC 35 is prompted for the user

name and the password registered in the LAN switch 11 by the PC 31. In actual, the PC 35 disables to enter the correct data, so that the rewrite of the host table 14 is disabled. This operation, therefore, makes it possible to prevent the tapping by the false access of the PC 35. Further, the administrator of the system having received the message C can grasp what is going on the basis of the information stored in the message C and can take measures against the malignance.

In turn, the description will be oriented to another embodiment.

In the LAN switch 11 according to the first embodiment, the authenticating unit 15 is served to create the message A for prompting the user name and the password for the PC of the IP address of the entry included in the host table 14 indicated by the relaying unit 13, instruct the communicating unit 12 to send out the message A to the proper receive port to the packet, if no user name and password pre-registered in the authentication table 16 are found (including the case that a response is not given back within a given length of time), and notify the relaying unit of the rewrite inhibit of the entry of the host table 14. In the present embodiment, on the other hand, in addition to the foregoing process, the authenticating unit 15 is served to instruct the relaying unit 13 to disable (close) the port where the packet is received and discard all the packets received at the port. This additional process makes it possible to reduce the traffic load

burdened by the repetition of the prompt of entering the user name and the password to be executed when the IP address is erroneously set or a malignant user taps the PC of another user or passes himself or herself off as another PC by using the address of another PC.

According to the first embodiment, in the LAN switch 11, the authenticating unit 15 is served to create the message A for prompting the entry of the user name and the password for the PC of the IP address of the entry included in the host table 14 indicated by the relaying unit 13, instruct the communicating unit 12 to send out the message A to the proper receive port to the packet, if no user name and password pre-registered in the authentication table 16 are found (including the case that the response is not given back within a given length of time), and notify the relaying unit 13 of the inhibit of rewriting the entry of the host table 14. In the present embodiment, on the other hand, in addition to the process, the authenticating unit 15 is served to create a message of warning the users of all the PCs belonging to the VLAN having the same source IP address of the packet of the possibilities that the IP address is erroneously set and a malignant user taps the data or does false communications by using the address of another PC and to instruct the communicating unit 12 to send out the warning message. The foregoing process makes it possible to warn the concerned person and the other possible concerned persons of the erroneous setting of the IP address and the tapping or false communication by the

malignant user with the address of another PC.

In the LAN switch 11 according to the first embodiment, the authenticating unit 15 is served to newly create or rewrite an entry of the host table 14 and prompt the user name and the password for the PC of the IP address of the entry when an inquiry as to if the rewrite (including the new creation) is enabled is received from the relaying unit 13. In actual, however, the authenticating unit 15 is served to periodically prompt the user name and the password for the PC of the IP address of each entry and check if the user is true. The foregoing process makes it possible to check if the IP address or the like may be erroneously set or a malignant user may tap the data or do false communications by using the address of another PC with regard to the PCs dedicated to receiving the packets.

In the LAN switch 11 according to the first embodiment, the relaying unit 13 is served to inquire the authenticating unit 15 of rewriting the entry if the corresponding entry of the host table 14 to the source IP address of the received packet may be newly created or rewritten. As to the destination IP address of the received packet, similarly, if the entry having the corresponding source IP address to the destination IP address of the host table 14 is newly created or rewritten, the relaying unit is served to inquire the authenticating unit 15 of the rewrite of the entry. If the rewrite is enabled, the entry may be rewritten. The foregoing process makes it possible to check if the IP address or the like

may be erroneously set or a malignant user may tap the data or do false communications by using the address of another PC with respect to the PCs set not to transmit the packet but to receive the packets.

In the first embodiment, the description will be oriented to the IP subnet-based VLAN. In place, it may hold true to another type VLAN such as a port based VLAN, a MAC address based VLAN, or a Layer 3 protocol based VLAN.

As described above, the management method of the communications network and the LAN switch according to each embodiment of the invention make it possible to prevent tapping and false communications by a malignant user, thereby improving the security against the communications network system.

Further, by notifying the true user or the administrator of the system of the information such as a user name obtained by the user authentication, it is possible to easily analyze the cause of failure by erroneous setting of the IP address or the like, thereby making the recovery faster.

Moreover, the foregoing embodiment has concerned with the communications network system provided with the VLAN to which the present invention applies. In place, the present invention may apply to the communications network provided with the mobile IP. That is, in the communications network provided with the mobile IP, when the mobile terminal is moved between the subnetworks, the similar problem to the communications network system provided with

the VLAN takes place. Hence, when changing the connecting information of the mobile terminal, like the foregoing embodiment, by authenticating the user, the communications network system provided with the mobile IP enables to prevent erroneous setting or incorrect use of the IP address. In this case, in place of the LAN switch, any network relaying device (for example, router) will do if it may support the mobile IP.

WHAT IS CLAIMED IS:

1. A network relaying apparatus comprising:

a plurality of I/O ports connected to network terminals;

means for storing information relating to a connecting state of said network terminal, said information indicating correspondence between each of said I/O ports and a network address of said network terminal connected to each of said I/O ports;

means for storing user authentication information for each of said network addresses;

packet communicating means for transmitting and receiving packets through said I/O ports;

packet relaying means for determining a destination of the packet received from each of said plurality of I/O ports by said packet communicating means on a basis of the information held by said means for storing the information relating to the connecting state of said network terminal and instructing said packet communicating means to transmit said received packet; and

user authenticating means for determining if the user authentication information specified against said network address is correct on a basis of the user authentication information stored in said means for storing the authentication information,

wherein said packet relaying means operates to learn correspondence between the I/O port for receiving said received packet and said source network address on a

basis of the source network address information contained in said received packet, request the user authentication information for the source network terminal if the change of the content of said means for storing the information relating to the connecting state of the network terminal is required by said learned result, specify the user authentication information transmitted by said source network terminal, instruct said user authenticating means to execute the user authentication, and change the content of said means for storing the information relating to the connecting state of said network terminal and relay said received packet if the user is authenticated to be correct.

2. A network relaying apparatus as claimed in claim 1, wherein said network relaying device is a LAN switch including a virtual LAN.

3. A network relaying apparatus as claimed in claim 1, wherein if the user authentication indicates the user is not correct for said network address, said packet communicating means operates to suppress the change of the content of said means for storing the information relating to the connecting state of said network terminal and discard the received packet having caused the change.

4. A network relaying apparatus as claimed in claim 1, wherein the user authentication information stored in said storing means contains a contact mail address of the concerned user, and said user authenticating means operates to create a message for indicating that a packet having the incorrect user authentication information has been trans-

mitted to a contact mail address registered in said means for storing the user authentication information if the user authentication information is determined to be incorrect for said network address as a result of said user authentication and to instruct said packet communicating means to transmit said message.

5. A network relaying apparatus as claimed in claim 1, further comprising means for storing a contact mail address of an administrator of said network relaying device, wherein said user authenticating means operates to create a message for indicating that a packet having the incorrect user authentication information has been transmitted to a correct mail address of an administrator of said network relaying apparatus if the user authentication is determined to be incorrect for said network address as a result of said user authentication and to instruct said packet communicating means to transmit said message.

6. A network relaying apparatus as claimed in claim 1, wherein said network address is an IP address.

7. A network relaying apparatus as claimed in claim 1, wherein said network relaying means communicates by using a mobile IP.

8. A communication control method in a communications network system having plural network terminals and a network relaying device connected through a communication path, said network relaying device having a plurality of I/O ports connected with said network terminals and means for storing information relating to a connecting state of

said network terminal, said information indicating correspondence between each of said I/O ports and a network address of each of said network terminals connected to said I/O ports, comprising the steps of:

registering user authentication information for each network address of each of said network terminals;

receiving packets transmitted by a first network terminal through said I/O port;

if a source network address contained in said received packet does not correspond to said receive I/O port stored in said means for storing the information relating to a connecting state of said network terminal, updating a content of said means for storing a connecting state of said network terminal so that said source network address may correspond to said receive I/O port;

determining a destination of said received packet based on the information held in said means for storing the information relating to a connecting state of said network terminal and transmitting said received packet; and

when updating the content of said means for storing the information relating to a connecting state of said network terminal, requesting user authentication information for said first network terminal, for doing user authentication on a basis of the user authentication information registered for each network address if said source network address does not correspond to said receive I/O port stored in said means for storing the information relating to a connecting state of said network terminal,

and changing the content of said means for storing the information relating to a connecting state of said network terminal and transmitting said received packet if the correct user authentication information is obtained.

9. A communication control method as claimed in claim 8, further comprising the steps of:

if the correct user authentication information cannot be obtained from said first network terminal, suppressing a change of the content of said means for storing the information relating to a connecting state of said network terminal and discarding said received packet.

10. A communication control method as claimed in claim 9, further comprising the step of:

if the correct user authentication information cannot be obtained from said first network terminal, suppressing the transfer of the packets at the I/O port having received said packet.

11. A communication control method as claimed in claim 8, further comprising the steps of:

registering said user authentication information and a contact mail address of the concerned user for each network address; and

if the correct user authentication information cannot be obtained from said first network terminal, transmitting to a contact mail address registered in said source network address a message for indicating that a packet having incorrect user authentication information has been transmitted.

12. A communication control method as claimed in claim 8, further comprising the step of:

registering a contact mail address of an administrator of said network relaying device; and

if the correct user authentication information cannot be obtained from said first network terminal, transmitting to a contact mail address of the administrator of said network relaying apparatus a message for indicating that a packet having incorrect user authentication information is transmitted.

13. A communication control method as claimed in claim 8, wherein said network address is an IP address.

14. A communication control method as claimed in claim 13, wherein said network relaying apparatus is a LAN switch including a virtual LAN.

15. A communication control method as claimed in claim 14, wherein if the correct user authentication information cannot be obtained from said first network terminal, a message for indicating transmission of a packet having incorrect user authentication information is transmitted to all the network terminals of the VLAN whose address belongs to the source network address of said received packet.

16. A communication control method as claimed in claim 8, further comprising the steps of:

when determining a destination of said received packet, if the correspondence between the destination network address of said received packet and the I/O port

needs the update of the content of said means for storing the information relating to a connecting state of said network terminal, requesting user authentication information for the network terminal of said destination network address for the purpose of doing the user authentication on a basis of the user authentication information registered at each network address, and updating the content of said means for storing the information relating to a connecting state of said network terminal and transmitting said received packet if no correct user authentication information can be obtained.

17. A communication control method as claimed in claim 8, further comprising the step of:

requesting the user authentication information for each network address held in said means for storing the information relating to a connecting state of said network terminal, for the purpose of periodically doing the user authentication on a basis of the user authentication information registered in each network address.

18. A program for controlling communications in a communications network system having a plurality of network terminals and a network relaying device through a communication path, said network relaying apparatus having a plurality of I/O ports connected with said network terminals and means for storing information relating to a connecting state of said network terminal, said information indicating correspondence between each of said I/O ports and a network address of each of said network terminals

connected with said I/O ports, said relaying apparatus operating to receive packets transmitted by said network terminals through said I/O ports, if a source network address contained in said received packet does not correspond with said receive I/O port stored in said means for storing the information relating to a connecting state of said network terminal, update the content of said means for storing the information relating to a connecting state of said network terminal so as to make the correspondence correct, determine a destination of said received packet on a basis of the information stored in said means for storing the information relating to a connecting state of said network terminal, and transmit said received packet, said program containing a program code taking the steps of:

registering user authentication information at the network address of each of said network terminals; and

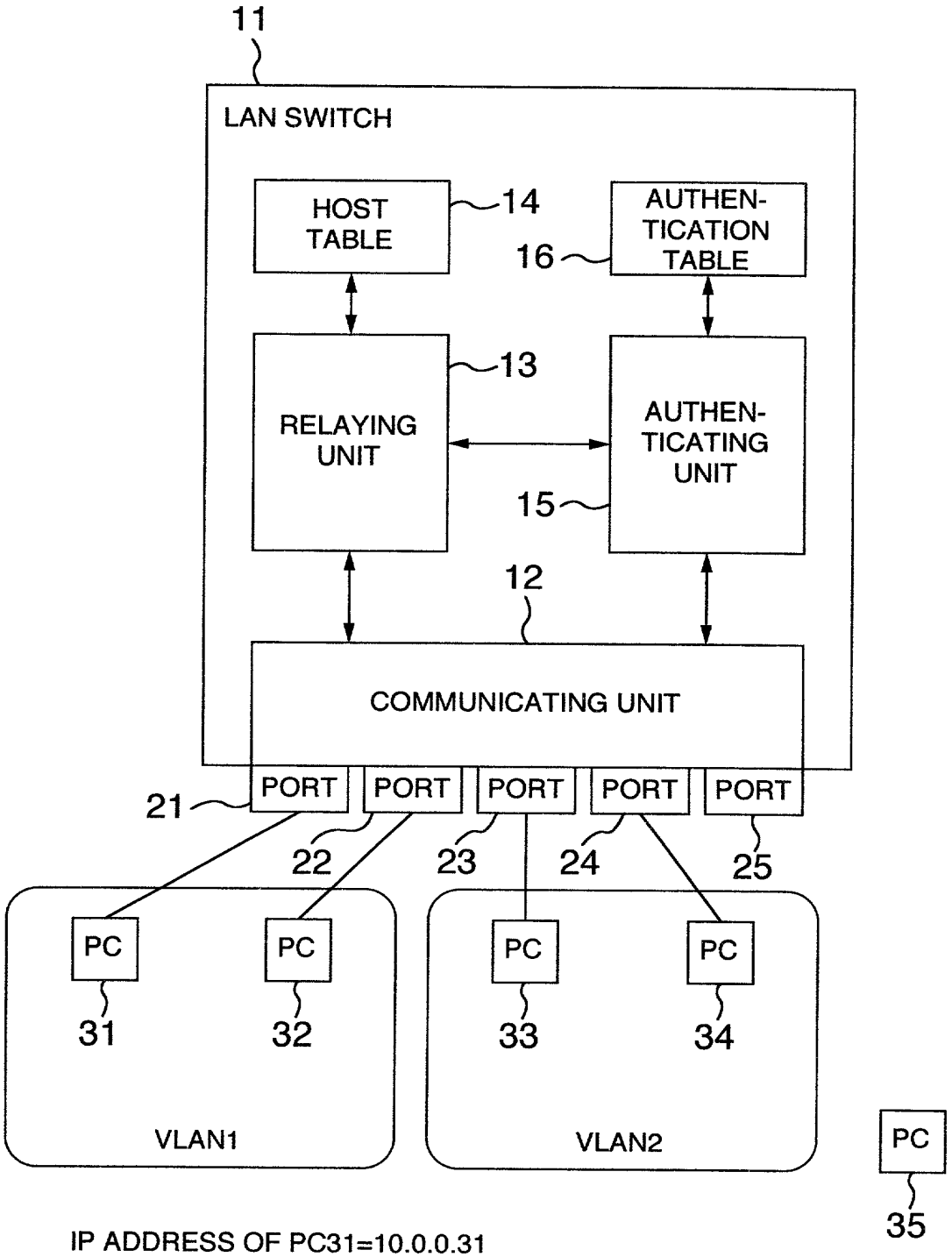
when updating a content of said means for storing the information relating to a connecting state of said network terminal, if said source network address does not correspond with said receive I/O port stored in said means for storing the information relating to a connecting state of said network terminal, requesting user authentication information for said first network terminal for doing user authentication on a basis of the user authentication information registered at said network address, and changing a content of said means for storing the information relating to a connecting state of said network terminal and

transmitting said received packet if the correct user authentication information can be obtained.

ABSTRACT OF THE DISCLOSURE

A LAN switch is one component of a communications network system composed of a virtual LAN having network terminals such as personal computers connected with ports respectively. The LAN switch provides a host table for holding correspondence between each port and address information of the network terminal connected to each port and an authentication table for holding information for authenticating a user of each network terminal. If a request takes place of changing the correspondence about the source network terminal held in the host table when relaying the packets, the LAN switch prompts a user name and a password for the source network terminal, does user authentication on the basis of the information held in an authentication table, and enables rewrite of the host table and relay of the packets if the user is correct. These processes are executed for easily preventing false use of an address or tapping or false access by a malignant user as well as analyzing or recovering the erroneously set address.

FIG.1



IP ADDRESS OF PC31=10.0.0.31
IP ADDRESS OF PC32=10.0.0.32
IP ADDRESS OF PC33=10.0.0.33
IP ADDRESS OF PC34=10.0.0.34

FIG.2

14

HOST TABLE

14a SOURCE IP ADDRESS	14b SOURCE MAC ADDRESS	14c DESTINATION MAC ADDRESS	14d PORT NUMBER	14e VLAN
10.0.0.31	10:00:00:00:00:31	10:00:00:00:00:51	21	1
10.0.0.32	10:00:00:00:00:32	10:00:00:00:00:52	22	1
10.0.0.33	10:00:00:00:00:33	10:00:00:00:00:53	23	2
10.0.0.34	10:00:00:00:00:34	10:00:00:00:00:54	24	2

FIG.3

16

AUTHENTICATION TABLE

16a IP ADDRESS	16b USER NAME	16c PSSWORD	16d CONTACT MAIL ADDRESS
10.0.0.31	PC31	PSS31	pc31@hitachi.co.jp, sw11a@hitachi.co.jp
10.0.0.32	PC32	PSS32	pc32@hitachi.co.jp, sw11a@hitachi.co.jp
10.0.0.33	PC33	PSS33	pc33@hitachi.co.jp, sw11a@hitachi.co.jp
10.0.0.34	PC34	PSS34	pc34@hitachi.co.jp, sw11a@hitachi.co.jp

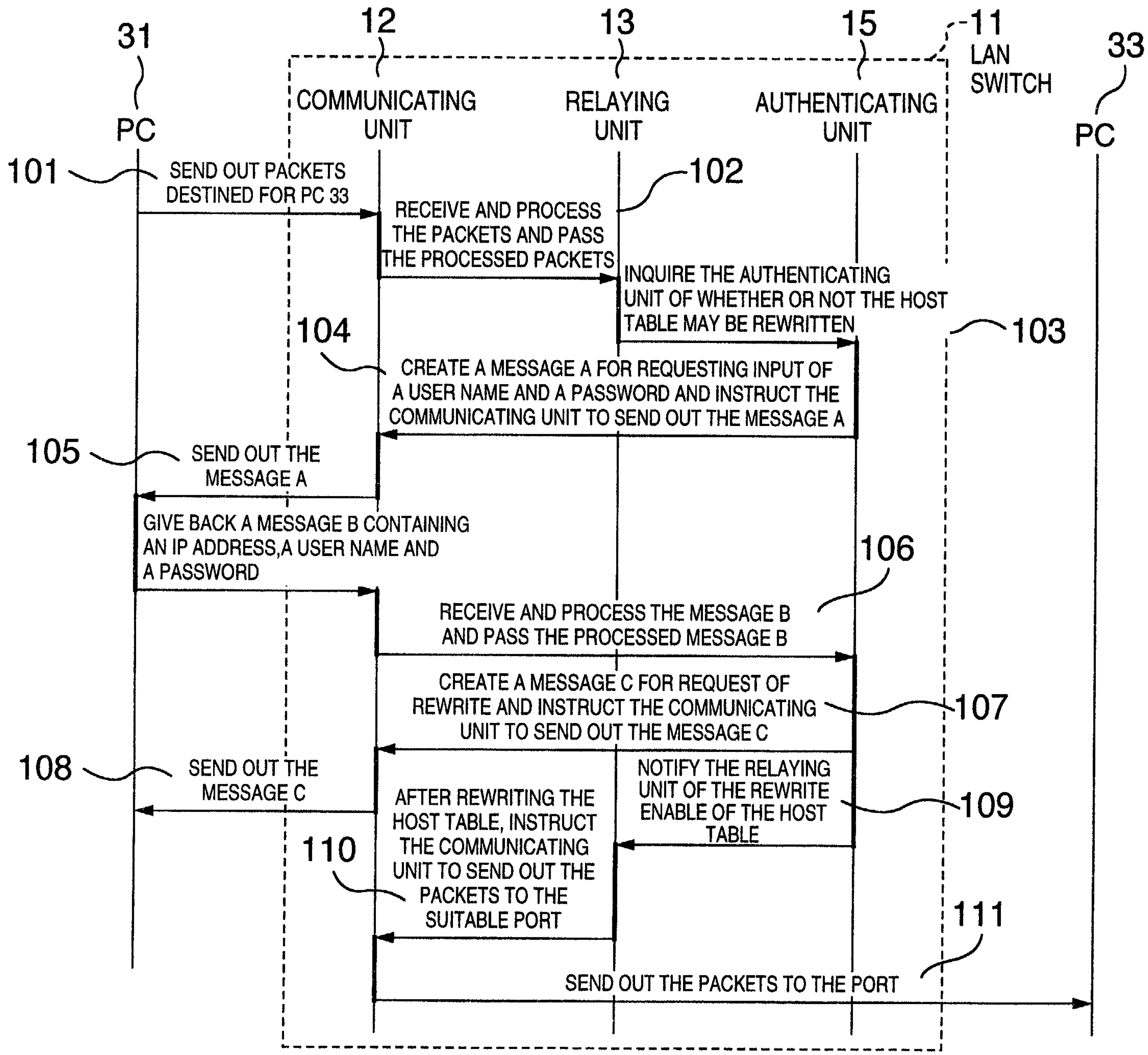

31
PC
12
COMMUNICATING UNIT
13
RELAYING UNIT
15
AUTHENTICATING UNIT
11
LAN SWITCH
33
PC
101
SEND OUT PACKETS DESTINED FOR PC 33
RECEIVE AND PROCESS THE PACKETS AND PASS THE PROCESSED PACKETS
102
INQUIRE THE AUTHENTICATING UNIT OF WHETHER OR NOT THE HOST TABLE MAY BE REWRITTEN
103
104
CREATE A MESSAGE A FOR REQUESTING INPUT OF A USER NAME AND A PASSWORD AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE A
105
SEND OUT THE MESSAGE A
GIVE BACK A MESSAGE B CONTAINING AN IP ADDRESS,A USER NAME AND A PASSWORD
106
RECEIVE AND PROCESS THE MESSAGE B AND PASS THE PROCESSED MESSAGE B
CREATE A MESSAGE C FOR REQUEST OF REWRITE AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE C
107
108
SEND OUT THE MESSAGE C
NOTIFY THE RELAYING UNIT OF THE REWRITE ENABLE OF THE HOST TABLE
109
110
AFTER REWRITING THE HOST TABLE, INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE PACKETS TO THE SUITABLE PORT
111
SEND OUT THE PACKETS TO THE PORT

FIG.4

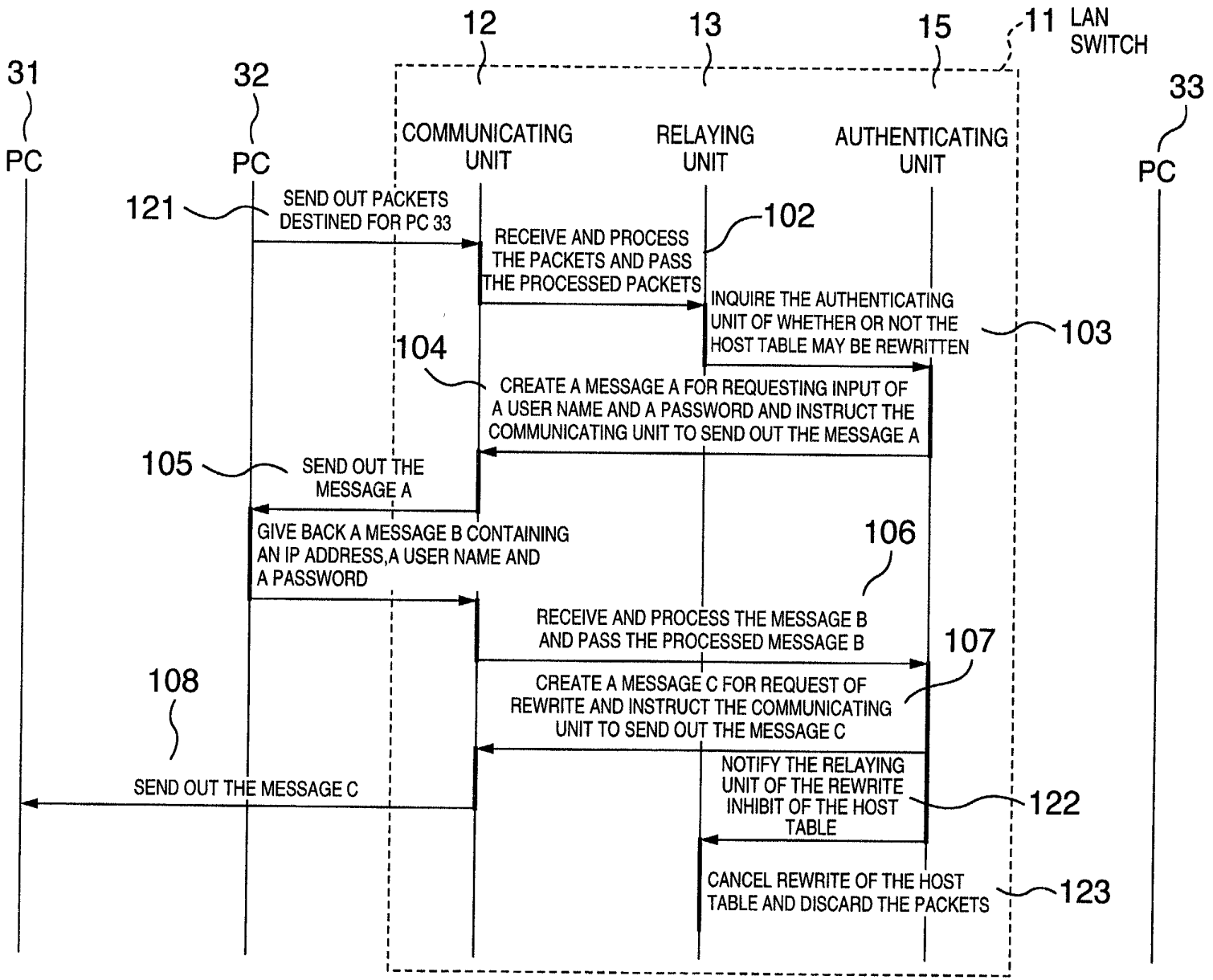
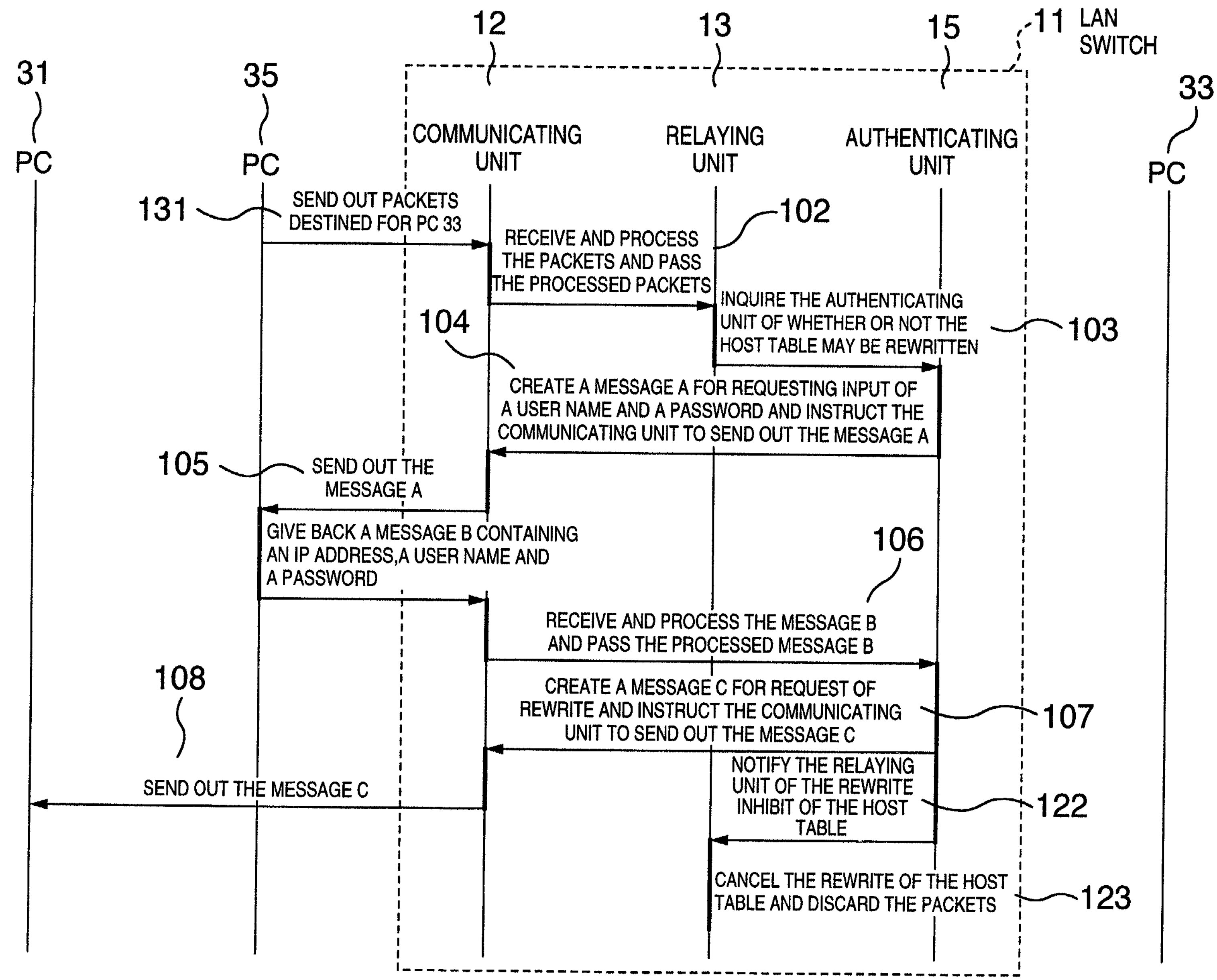

12
13
15
11 LAN SWITCH
31
32
33
PC
PC
PC
COMMUNICATING UNIT
RELAYING UNIT
AUTHENTICATING UNIT
121
SEND OUT PACKETS DESTINED FOR PC 33
102
RECEIVE AND PROCESS THE PACKETS AND PASS THE PROCESSED PACKETS
INQUIRE THE AUTHENTICATING UNIT OF WHETHER OR NOT THE HOST TABLE MAY BE REWRITTEN
103
104
CREATE A MESSAGE A FOR REQUESTING INPUT OF A USER NAME AND A PASSWORD AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE A
105
SEND OUT THE MESSAGE A
GIVE BACK A MESSAGE B CONTAINING AN IP ADDRESS,A USER NAME AND A PASSWORD
106
RECEIVE AND PROCESS THE MESSAGE B AND PASS THE PROCESSED MESSAGE B
107
CREATE A MESSAGE C FOR REQUEST OF REWRITE AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE C
108
SEND OUT THE MESSAGE C
NOTIFY THE RELAYING UNIT OF THE REWRITE INHIBIT OF THE HOST TABLE
122
CANCEL REWRITE OF THE HOST TABLE AND DISCARD THE PACKETS
123

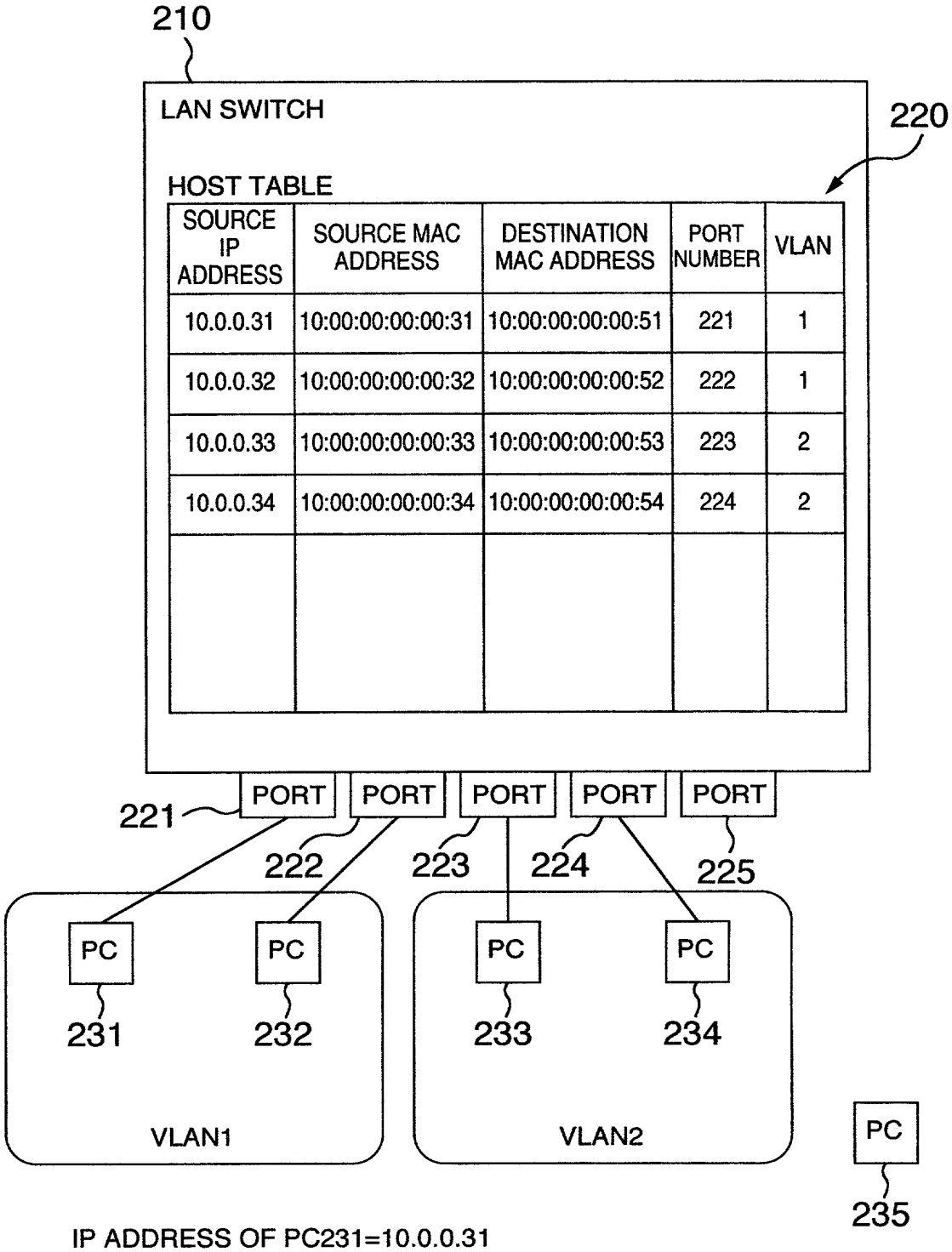
FIG.5

FIG.6



11 LAN SWITCH
12
13
15
31
35
33
PC
PC
PC
COMMUNICATING UNIT
RELAYING UNIT
AUTHENTICATING UNIT
131
SEND OUT PACKETS DESTINED FOR PC 33
RECEIVE AND PROCESS THE PACKETS AND PASS THE PROCESSED PACKETS
102
INQUIRE THE AUTHENTICATING UNIT OF WHETHER OR NOT THE HOST TABLE MAY BE REWRITTEN
103
104
CREATE A MESSAGE A FOR REQUESTING INPUT OF A USER NAME AND A PASSWORD AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE A
105
SEND OUT THE MESSAGE A
GIVE BACK A MESSAGE B CONTAINING AN IP ADDRESS,A USER NAME AND A PASSWORD
106
RECEIVE AND PROCESS THE MESSAGE B AND PASS THE PROCESSED MESSAGE B
108
CREATE A MESSAGE C FOR REQUEST OF REWRITE AND INSTRUCT THE COMMUNICATING UNIT TO SEND OUT THE MESSAGE C
107
SEND OUT THE MESSAGE C
NOTIFY THE RELAYING UNIT OF THE REWRITE INHIBIT OF THE HOST TABLE
122
CANCEL THE REWRITE OF THE HOST TABLE AND DISCARD THE PACKETS
123

FIG.7



IP ADDRESS OF PC231=10.0.0.31
IP ADDRESS OF PC232=10.0.0.32
IP ADDRESS OF PC233=10.0.0.33
IP ADDRESS OF PC234=10.0.0.34

E4941-01

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name. I believe I am the original, first and sole inventor (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below), of the subject matter claimed and for which a patent is sought on the invention entitled:

"COMMUNICATIONS CONTROL METHOD AND INFORMATION RELAYING DEVICE FOR COMMUNICATIONS NETWORK SYSTEM"

the specification of which: (check one) [X] is attached hereto.

[ ] was filed on _____

as Application Serial No. _____

and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information material to examination of this application according to Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b)of any foreign application (s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

			Priority Claimed	
10-347235 (Number)	Japan (Country)	7 December, 1998 (Day/Month/Year Filed)	[X] Yes	[ ] No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	[ ] Yes	[ ] No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	[ ] Yes	[ ] No

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

_____ (Application Number)	_____ (Filing Date)	_____ (Status -- patented, pending, abandoned)
_____ (Application Number)	_____ (Filing Date)	_____ (Status -- patented, pending, abandoned)

I hereby claim the benefit under Title 35, United States Code, Section 120, of any United States application(s) or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby appoint the following attorneys/agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith and with any divisional, continuation, continuation-in-part, reissue or re-examination application with full power of appointment and substitution of associate attorneys and agents, and to receive all patents which may issue thereon: Thomas E. Beall, Jr., Reg. No. 22,410; John R. Mattingly, Reg. No. 30,293; Daniel J. Stanger, Reg. No. 32,846; Shrinath Malur, Reg. No. 34,663; Gene W. Stockman, Reg. No. 21,021; Jeffrey M. Ketchum, Reg. No. 31,174; Scott W. Brickner, Reg. No. 34,553. Address all correspondence to:

BEALL LAW OFFICES
104 East Hume Avenue
Alexandria, Virginia 22301
Tel. 703-684-1120

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, Section 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date Nov.22,1999 Inventor Kazuaki TSUCHIYA Kazuaki Tsuchiya
(Typed Name and Signature)
Residence Ebina-shi, Japan Citizenship Japan
Post Office Address 960-1-403, Kamigo, Ebina-shi, Japan.

Date Nov.22,1999 Inventor Shinji NOZAKI Shinji Nozaki
(Typed Name and Signature)
Residence Yokohama-shi, Japan Citizenship Japan
Post Office Address 546-9-504, Shinanocho, Totsuka-ku, Yokohama-shi, Japan.